Silicon Sensors for Calibration of ATLAS Muon Chambers

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For the ATLAS experiment at the future LHC collider at CERN, 88 muon chambers are constructed in collaboration between Dubna, MPI München, and LMU. The chambers are made of 432 drift tubes, arranged in two multilayers of three layers each, as shown in figure 1. In addition to the alignment system within each chamber, aluminium support platforms ("alignment platforms") are glued onto the lower multilayer of each chamber to mount an optical alignment system that will monitor inter-chamber distances during ATLAS operation.

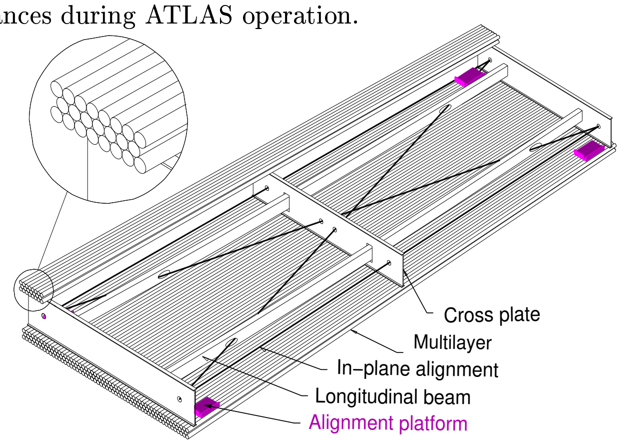

Fig. 1: A schematic drawing of a muon chamber.

In the cosmic ray test facility at LMU [1], the sense wire positions are measured. However, the position of the alignment platforms cannot be determined yet, and thus an absolute calibration of the inter-chamber distances in ATLAS would have to rely on measurements made during chamber production.

To obtain measurements of the alignment platform positions, two $6.4 \times 6.4\,\mathrm{cm}^2$ silicon sensors, each with 512 readout strips at a pitch of $120\,\mu\mathrm{m}$ [2] will be mounted on each alignment platform of the chamber being tested in the cosmic ray test facility.

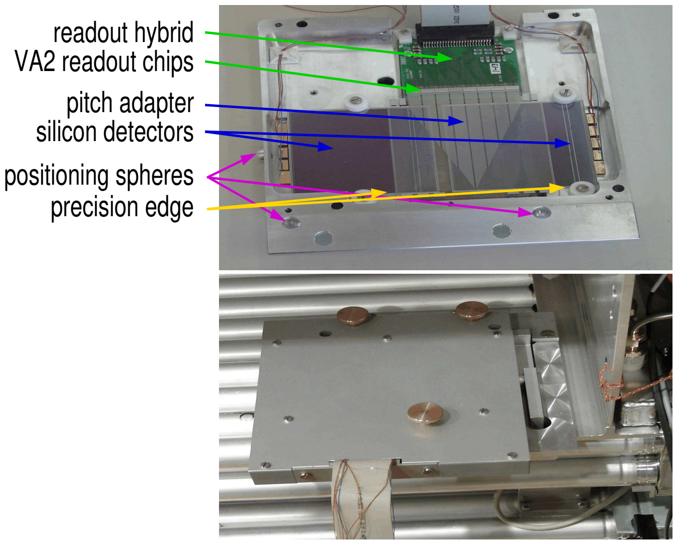

Fig. 2: The silicon sensors within the box, and a box mounted on a muon chamber.

Aluminium boxes containing the sensors and the VA2 [3] readout hybrid have been constructed at LMU. The distance between the precision edge for positioning the sensors and the positioning spheres that define the box position on the alignment platform is known to a mechanical precision of $10\,\mu\mathrm{m}$. Figure 2 shows the placement of silicon sensors within a box, and a box mounted on a muon chamber.

High momentum muons passing through a silicon sensor will generate signals both in the silicon detector and in the muon chamber that supports it. Since the wire positions of the chamber are measured in the cosmic ray test facility, the correlation between signals in the silicon and the drift tube then allows for a position measurement of the alignment platforms.

The limited angular acceptance of the cosmic ray test facility at the chamber edges will be extended with a dedicated scintillator trigger mounted on top of the silicon boxes as shown in figure 3. The silicon sensors will be integrated into the readout chain in early 2004, so that the alignment platform position measurements will become a routine part of the chamber calibration.

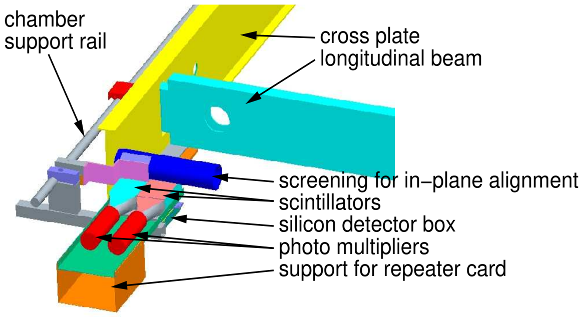

Fig. 3: Schematic drawing of one corner of a chamber with the additional scintillators for wide angle triggering.

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References

[1] J. Dubbert *et al.*, this report p. 88
[2] The silicon sensors have been manufactured for the ZEUS experiment. Their design is described in hep-ex/0212026 ("BMVD design").
[3] The VA2 readout chip is described here: `http://www.ideas.no/products/ASICs/pdf/VA2S2.pdf`.